PATENT APPLICATION

DISTRIBUTION FRAME HAVING ANGLED EQUIPMENT HOUSINGS AND INTERBAY STORAGE UNIT

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to a distribution frame of the type commonly utilized in a communications network. More specifically, the invention relates to a distribution frame for various communications equipment including equipment housings that are angled and an Interbay Storage Unit having a reduced width to increase the space available for routing and storing excess lengths of jumper cables on the distribution frame.

2. Background of the Invention

Distribution frames of the type commonly utilized in a communications network are constructed of a plurality of vertical frame members, referred to herein as "uprights," and a plurality of horizontal frame members, referred to herein as "supports." The supports join the uprights together to form an open, box-like frame for mounting communications equipment thereon and for routing jumper cables between the equipment. Typically, the height dimension of the distribution frame is substantially greater than the width dimension and the depth dimension. Thus, the distribution frame is relatively tall and narrow. The communications equipment is mounted within a plurality of equipment housings, each of which in turn is

mounted to the distribution frame for organization and ease of interchangeability of the equipment. The communications equipment is mounted compactly within the equipment housing and the housings are mounted in close proximity to maximize the amount of equipment that can be mounted on the distribution frame and the space available for routing and storing jumper cables.

For example, a plurality of equipment housings having communications equipment mounted therein may be mounted to the distribution frame in a vertical stacked orientation. **FIG. 1** illustrates an existing distribution frame **20** having a plurality of housings **22** (only 5 of which are shown for purposes of clarity) mounted on the distribution frame **20** in a vertical stacked orientation. Each of the housings **22** has at least one communications equipment module, panel, or the like **24** mounted within the housing **22**. The communications equipment module **24** may, for example, be a connector module including a plurality of adapters **26** for receiving jumper cables **28** to interconnect incoming (e.g., service) and outgoing (e.g., subscriber) transmission lines that are terminated on the connector modules **24**. The distribution frame **20** is constructed of a pair of vertically disposed uprights **21** that are joined together by a plurality of horizontally disposed supports **23** to form an open, generally rectangular equipment rack **25**. The uprights **21** of equipment rack **25** are typically more than about 60 inches in height and are spaced between about 19 and about 23 inches apart. Accordingly, the equipment rack **25** is relatively tall and narrow.

Each equipment housing **22** is generally rectangular in cross section and extends between the uprights **21** substantially the entire width of the equipment rack **25**. The jumper cables **28** are routed from an adapter **26** of a first connector module **24** through one or more routing guides **29** and strain relief devices (not shown) behind, underneath or alongside the

housings **22** to an adapter **26** of a second connector module **24** to interconnect the service and subscriber transmission lines terminated to the adapters **26** on the connector modules **24**. Because the housings **22** are stacked vertically on the equipment rack **25** in close proximity, there is very little space available for routing the jumper cables **28** between the connector modules **24** or for storing any excess lengths of the jumper cables. As a result, a need exists for a distribution frame with increased space available for routing and storing excess lengths of jumper cables on the distribution frame.

SUMMARY OF THE INVENTION

The above objectives and advantages, as well as others, are realized and attained by the present invention. Additional features and advantages of the invention will be set forth in the written description that follows, as well as the accompanying drawings, or will be readily apparent from the description, or may be learned by practice of the invention.

In a particular embodiment, the invention is a housing for mounting communications equipment. The housing includes a generally planar upper wall having a first edge and a second edge and a generally planar lower wall substantially parallel to and spaced from the upper wall. The lower wall likewise has a first edge and a second edge. The housing further includes an outer wall extending between the first edge of the upper wall and the first edge of the lower wall such that the outer wall forms an acute angle with one of the upper wall and the lower wall and forms an obtuse angle with the other of the upper wall and the lower wall. The housing may further includes an inner wall extending between the second edge of the upper wall and the second edge of the lower wall such that the inner wall forms an acute angle with one of the upper wall and the lower wall and forms an obtuse angle with the other of the

upper wall and the lower wall. At least one equipment module is mounted within the housing. Preferably, a plurality of equipment modules are mounted within the housing substantially parallel to the upper wall and the lower wall.

In another embodiment, the invention is a distribution frame of the type commonly utilized in a communications network for mounting communications equipment. The distribution frame includes a plurality of vertically disposed uprights and a plurality of horizontally disposed supports that join the uprights together to define a generally open, box-like equipment rack. The distribution frame further includes at least one housing secured to the equipment rack and at least one equipment module mounted within the housing. Preferably, the distribution frame includes a plurality of housings stacked vertically in a pair of parallel, spaced apart columns that define a center section therebetween and a plurality of equipment modules are mounted within each housing. Equipment modules in one of the housings of each of the columns are connected by a single length jumper cable that is routed between the equipment modules such that the excess length of the jumper cable is stored within the center section.

In another embodiment, the invention is an Interbay Storage Unit for routing and storing jumper cables on a distribution frame in a communications network. The Interbay Storage Unit includes a vertically disposed base and a plurality of storage hubs vertically spaced apart and extending outwardly from the base. The base has at least one reduced width section disposed between adjacent storage hubs. Preferably, the Interbay Storage Unit includes a plurality of pairs of storage hubs and the base has a reduced width section disposed between each pair of storage hubs. Each of the storage hubs is medially disposed between a pair of laterally spaced apart fingers extending outwardly from the base. The Interbay Storage

Unit may further include a first section and a second section wherein the fingers of the first section are laterally spaced apart a greater distance than the fingers of the second section.

In another embodiment, the invention is a distribution frame of the type commonly utilized in a communications network for mounting communications equipment. The distribution frame includes a plurality of vertically disposed uprights and a plurality of horizontally disposed supports that join the uprights together to define a generally open, box-like equipment rack. The distribution frame further includes an Interbay Storage Unit medially disposed between the uprights and secured to the equipment rack. The Interbay Storage Unit includes a vertically disposed base and a plurality of storage hubs vertically spaced apart and extending outwardly from the base. The base of the Interbay Storage Unit has at least one reduced width section disposed between adjacent storage hubs.

In yet another embodiment, the invention is a distribution frame of the type commonly utilized in a communications network for mounting communications equipment. The distribution frame includes a plurality of vertically disposed uprights and a plurality of horizontally disposed supports that join the uprights together to define a generally open, box-like equipment rack. The distribution frame further includes at least one housing secured to the equipment rack and at least one equipment module mounted within the housing. Preferably, the distribution frame includes a plurality of housings stacked vertically in a pair of parallel, spaced apart columns that define a center section therebetween and a plurality of equipment modules mounted within each housing. The distribution frame further includes an Interbay Storage Unit disposed medially between the columns of housings and secured to the equipment rack. Equipment modules of one of the housings of each of the columns are connected by a single length jumper cable such that the excess length of the jumper cable is

routed and stored within the Interbay Storage Unit. The distribution frame may further include a plurality of routing guides attached to the housings and arranged in a staggered orientation from the rear of the distribution frame.

BRIEF DESCRIPTION OF THE DRAWINGS

The accompanying drawings, which are incorporated in and constitute a part of this specification, illustrate one or more embodiments of the invention described more fully below and together with the following detailed description, serve to further explain the invention. More specifically, in the drawings:

FIG. 1 is a perspective view of a prior art distribution frame having a plurality of equipment housings mounted thereon in vertical stacked orientation;

FIG. 2 is a perspective view of a distribution frame constructed in accordance with the invention;

FIG. 3 is a front view of the upper portion of the distribution frame of **FIG. 2**;

FIG. 4 is a side view of the upper portion of the distribution frame of **FIG. 2**;

FIG. 5 is a rear view of the upper portion of the distribution frame of **FIG. 2**;

FIG. 6 is a top view of the distribution frame of **FIG. 2**;

FIG. 7 is a perspective view of a typical equipment housing constructed in accordance with the invention for mounting on the distribution frame of **FIG. 2**;

FIG. 8 is a perspective view of an Interbay Storage Unit constructed in accordance with the invention for mounting on the distribution frame of **FIG. 2**;

FIG. 9 is a front view of the Interbay Storage Unit of **FIG. 8**;

FIG. 10 is a side view of the Interbay Storage Unit of **FIG. 8**;

FIG. 11 is a front view of the distribution frame of **FIG. 2** showing the Interbay Storage Unit of **FIG. 8** and a plurality of the equipment housings of **FIG. 7** mounted on the distribution frame with a plurality of equipment modules mounted within each of the housings; and

FIG. 12 is a vertical sectional view of the distribution frame of **FIG. 11** showing a plurality of routing guides for routing jumper cables between the equipment modules mounted within the equipment housings on the distribution frame.

DETAILED DESCRIPTION OF THE INVENTION

One or more embodiments of the invention will be described hereinafter in sufficient detail to permit one of ordinary skill in the art to make, use and practice the invention without undue experimentation. The embodiments shown and described herein are exemplary only and are not intended to limit the scope of the invention, as defined by the appended claims, in any manner. Instead, the invention is intended to be construed broadly with reference to this detailed description and the accompanying drawings, in which like reference numerals indicate like parts in the various views.

A distribution frame **30** constructed in accordance with the invention is shown in **FIGS. 2-6**. The distribution frame **30** comprises at least two vertically disposed upright **31** and a plurality of horizontally disposed supports **33**. The uprights **31** and the supports **33** may be made of any suitable material, such as metal or rigid plastic. The supports **33** join the uprights **31** together to form an open, generally rectangular, box-like equipment rack **35** for mounting various communications equipment thereon, as will be described. The uprights **31** of equipment rack **35** are typically more than about 60 inches in height and are spaced apart a distance greater than about 23 inches. Most preferably, however, the uprights **31** are spaced

apart a distance greater than about 30 inches to permit a plurality of equipment housings **40** and an Interbay Storage Unit **60** to be mounted on the distribution frame **30**, as will be described. Accordingly, the equipment rack **35** is relatively tall and narrow. A plurality of openings **32** may be formed through each of the uprights **31** for aesthetics, or if necessary, to provide access to the communications equipment mounted on the equipment rack **35**. The supports **33** may have any suitable construction, such as a box, C-shaped or flat beam, that provides sufficient rigidity to the equipment rack **35** when affixed to the uprights **31**. As shown, the distribution frame **30** may also comprise a base **34** that extends outwardly from the uprights **31** to provide further rigidity to the equipment rack **35** in the upright, operational position.

The distribution frame **30** further comprises a plurality of equipment housings **40** mounted thereon in a vertical stacked orientation. A typical equipment housing **40** constructed in accordance with the invention is shown in greater detail in **FIG. 7**. The equipment housings **40** are arranged in parallel columns adjacent the uprights **31** of the distribution frame **30** and are spaced apart sufficiently so that a central cavity **36** is formed therebetween. The central cavity **36** defines a center section **38** for a purpose to be described. Housing **40** comprises an inner wall **41**, an outer wall **42**, a lower wall **43**, an upper wall **44** and a rear wall **45**. Together, the inner wall **41**, the outer wall **42**, the lower wall **43**, the upper wall **44** and the rear wall **45** define a cavity **46** such that the housing **40** is generally box-shaped and open towards the front. A mounting flange **48** is attached to and extends outwardly from the outer wall **42**. The mounting flange **48** has a first portion **48a** that is generally perpendicular to the outer wall **42** and a second portion **48b** that is generally parallel to the outer wall **42**. The first portion **48a** has a plurality of holes **47** and an elongate opening

49 formed therethrough. Each of the equipment housings **40** is secured to one of the uprights **31** by a plurality of fasteners (not shown) that extend through the openings **47** of the first portion **48a** of the mounting flange **48**. Alternatively, or in addition, the housing **40** may be secured to the upright **31** in any other suitable manner. For example, the housing may be secured by fasteners through openings formed in the outer wall **42**, or by interlocking a channel (not shown) provided on the upright **31** with a bracket **48c** fixed to the outer wall **42** of the housing **40**.

Inner wall **41** and outer wall **42** are parallel to one another and extend vertically between lower wall **43** and upper wall **44**. Similarly, lower wall **43** and upper wall **44** are parallel to one another and extend laterally between inner wall **41** and outer wall **42**. However, inner wall **41** and outer wall **42** are not perpendicular to lower wall **43** and upper wall **44**. Together, the walls **41**, **42**, **43**, **44** form a non-rectangular parallelogram that defines an open, box-like equipment housing **40** for mounting various communications equipment. The rear wall **45** may be included to provide additional rigidity or additional surface area for mounting the communications equipment or strain relief brackets. As best shown in **FIG. 3**, the lower wall **43** and the upper wall **44** are angled downwardly in the direction of the center section **38** from the outer wall **42** to the inner wall **41** when the equipment housing **40** is mounted to the upright **31** of the equipment rack **35**. As a result, additional space is available within the center section **38** between the housings **40** mounted on the uprights **31** of the equipment rack **35** for routing and storing jumper cables.

The distribution frame **30** further comprises an Interbay Storage Unit **60** mounted thereon in a vertical orientation. An Interbay Storage Unit **60** constructed in accordance with the invention is shown in greater detail in **FIGS. 8-10**. The Interbay Storage Unit **60** is

mounted medially within the center section **38** of the distribution frame **30** between the vertical columns of housings **40**, and preferably, is mounted within the center section **38** equidistant from the housings **40**. The Interbay Storage Unit **60** may be secured to the equipment rack **35** in any suitable manner, for example, to a rear panel extending between the top and the bottom of the equipment rack **35**, or to one or more lateral supports extending between the uprights **31** of the equipment rack **35**. As shown, the Interbay Storage Unit **60** is secured to the support **33** adjacent the top of the equipment rack **35** and to the base **34** adjacent the bottom of the equipment rack **35**. Preferably, the Interbay Storage Unit **60** comprises a vertically disposed base **62** having a plurality of storage hubs **64** extending outwardly therefrom in a cantilevered fashion. The storage hubs **64** depend substantially perpendicular from the base **62** towards the front of the distribution frame **30**. Each storage hub **64** is medially disposed between a pair of side panels, referred to herein as "fingers," **66** that are affixed to and extend outwardly from the base **62** in a cantilevered fashion.

The base **62** of the Interbay Storage Unit **60** is configured to have a reduced width section **63** between each pair of adjacent storage hubs **64**. As shown, the reduced width sections **63** are centrally disposed between adjacent storage hubs **64** so that the base **62** presents a "scalloped" appearance when viewed from the front or rear of the distribution frame **30**. The reduced width sections **63** increase the space available between the base **62** and the inner walls **41** of the housings **40** for routing jumper cables vertically between the communication equipment within the housings **40**. In addition, the reduced width sections **63** reduce the weight of the Interbay Storage Unit **60**, thereby reducing the necessary cross sectional area and thickness of the uprights **31** and the supports **33**. As shown, the width of the reduced width sections **63** is the same at each of the vertically spaced locations on the base

62. However, the width of the reduced width sections **63** may be further reduced so that additional space is available between the base **62** and the inner walls **41** of the housings **40** adjacent the base **34** of the distribution frame **30** where the excess lengths of single length jumper cables accumulate. The accumulation of excess lengths of jumper cables for communications equipment utilizing a single jumper cable length is commonly referred to in the art as "jumper cable pile up." The lateral distance between each pair of fingers **66** is preferably greater near the base **34** of the distribution frame **30** to separate the jumper cables. The increased width **65** (**FIG. 9**) of the fingers **66** improves the ability of the Interbay Storage Unit **60** to store, separate and manage the high capacity of jumper cables in the area adjacent the base **34** of the distribution frame **30** where the excess lengths of the jumper cables accumulate. Nearer the top of the distribution frame **30**, the reduced width **67** of the fingers **66** maximizes the space available in center section **38** for jumper cable management. The angled equipment housings **40** also increase the vertical distance **69** (**FIG. 10**) between the storage hubs **64**, thereby further increasing the amount of space available in center section **38** to access, store and route jumper cables between the communications equipment mounted within the equipment housings **40**. The angled housings **40** also increase the height of the reduced width sections **63**, thereby maximizing the distance between the storage hubs **64** and facilitating access to the stored or routed jumper cables on the storage hubs **64** within the Interbay Storage Unit **60**.

FIG. 11 illustrates an exemplary embodiment of a distribution frame **30** constructed in accordance with the invention. The distribution frame **30** comprises an Interbay Storage Unit **60** and a plurality of the equipment housings **40** of the type previously described. The Interbay Storage Unit **60** and the housings **40** are mounted on the distribution frame **30** in the manner

previously described with a plurality of communications equipment modules **50** mounted within each of the housings. The communications equipment modules **50** may be any type of communications equipment, such as connector modules, panels, or the like, comprising splice organizers, splice trays, couplers or fan outs, and may be the same or different. In the exemplary embodiment shown and described herein, however, the equipment modules **50** are fiber optic connector modules including a plurality of adapters for receiving jumper cables to interconnect incoming (e.g., service) and outgoing (e.g., subscriber) transmission lines that are terminated to the adapters on the connector modules. The center section **38** of the distribution frame **30** provides space for routing connections, and in particular, single length jumper cables, between the equipment modules **50** mounted within the housings **40**. As shown, six connector modules **50**, each having a plurality of adapters (not shown) therein, are mounted within each of the housings **40**. Accordingly, a great number of jumper cables are required to interconnect the service and subscriber transmission lines terminated to the adapters.

An example of the routing one such single length jumper cable **70** is illustrated in **FIG. 11** and **FIG. 12**. In particular, the jumper cable **70** is routed from the front of a first connector module **52** over one or more routing guides **71** attached to the inner wall **41** of the housing **40**. The jumper cable **70** is then routed downwardly to the base **34** of the distribution frame **30** and underneath a semi-cylindrical routing guide **61** attached to the base **62** of the Interbay Storage Unit **60** adjacent the base **34** of the distribution frame **30**. Thereafter, the jumper cable **70** is routed upwardly between the left-hand fingers **66** and the storage hubs **64** as necessary to accommodate the excess length of the jumper cable **70**. The jumper cable **70** is then routed over the appropriate storage hub **64**, downwardly again to the routing guide **61**, and upwardly again over one or of the routing guides **71** to the front of a second connector

module **54**. It should be noted by reference to **FIG. 12** that the routing guides **71** transition from the rear of the distribution frame **30** towards the front of the distribution frame **30**. In the exemplary embodiment shown, pairs of the routing guides **71** are staggered on inner walls **41** outwardly from a location adjacent the rear wall **45** of the housing **40** near support **33** to a location adjacent the opening of the cavity **46** of the housing **40** near the base **34** of the distribution frame **30**. Staggering the locations of the routing guides **71** serves to further separate the accumulation of the jumper cables **70** adjacent the base **34** of the distribution frame **30** where jumper cable pile up tends to occur.

While the invention has been shown and described in various embodiments, it should be apparent to those skilled in the art that it is not so limited, but is susceptible to various changes without departing from the scope of invention. Accordingly, it is intended that the appended claims encompass any alternative embodiments of the invention not disclosed herein that are within the ordinary skill of a person knowledgeable in the art of distribution frames of the type commonly utilized in communications networks for interconnecting service and subscriber transmission lines and routing excess lengths of jumper cables between equipment housings mounted on the distribution frame.